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which is not reached by the ball is a limit point of points which it does reach. Since the paths of the ball from one side to the opposite side are parallel it follows that every point on the table not reached by the ball is a limit point of points which it does reach.

Evidently the same conclusion follows in the non-periodic cases in which the ball starts from a point other than a corner of the table.

DEPARTMENTS.

NOTE. All solutions of problems, problems for solution, and other department contributions should be sent direct to THE AMERICAN MATHEMATICAL MONTHLY, 1227 Clay Street, Springfield, Mo.

SOLUTIONS OF PROBLEMS.

NOTE. The following solutions were received too late for publication: Calculus, No. 196, solved by J. Scheffer, and A. H. Holmes; No. 197, solved and discussed by Miss Ida M. Schottenfels. Geometry, No. 255, solved by William Hoover; No. 257, solved by F. R. Honey. Mechanics, No. 179, solved by William Hoover, and J. Scheffer.

ALGEBRA.

234. Proposed by **G. W. GREENWOOD, M. A.** (Oxon). Professor of Mathematics and Astronomy, McKendree College, Lebanon, Ill.

Prove that $(x+n)^n-n(x+n-1)^n+\frac{n(n-1)}{2!}(x+n-2)^n-+\dots\dots\dots=n!$

Solution by the PROPOSER.

$\Delta u_x=u_{x+1}-u_x=(E-1)u_x$ where $Eu_x=u_{x+1}$.

Hence $(E-1)x^n=\Delta x^n$, $(E-1)^n x^n=\Delta^n x^n$, *i. e.*, $(x+n)^n-n(x+n-1)^n+\frac{n(n-1)}{2!}(x+n-2)^n-+\dots\dots=\Delta^n x^n!=n!$ by a well known theorem in the Calculus of Finite Differences.*

Also solved by J. Scheffer.

235. Proposed by **WILLIAM HOOVER, Ph. D.**, Athens, Ohio.

Easter Sunday, 1905, was on April 23. How often in the last one hundred years has this occurred, and when?†

Solution by the PROPOSER.

The Dominical Letter for April 23, 1905, is A. No other year thus far in the twentieth century had A for its Dominical Letter.

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*Epsteen, MONTHLY, June-July, 1904, p. 132.

†Dr. Zerr adds the remark that this will occur again in 1916 and 2000.

The years of the nineteenth century having A for their Dominical Letter were: 1809, 1815, 1820, 1826, 1837, 1843, 1848, 1854, 1865, 1871, 1876, 1882, 1893, the Epacts for which are 14, 20, 15, 22, 23, 0, 25, 1, 3, 9, 4, 11, 12.

Of these the years admissible must have the Epacts 24, 25, 26, 27, one only meeting the conditions, viz., 1848.

Also solved by J. Scheffer, and A. H. Holmes.

236. Proposed by **L. SHIVELY**, Mt. Morris College, Mt. Morris, Ill.

Sum to infinity the series $\dfrac{n^2}{(n+1)\,!}$ beginning with $n=1$.

Solution by **L. E. NEWCOMB**, Los Gatos, Cal.

The general term $\dfrac{n^2}{(n+1)!}=n\left(\dfrac{1}{n!}-\dfrac{1}{(n+1)\,!}\right)$. Set $n=1, 2, 3, \ldots\ldots$ in succession, and the series becomes

$$1-\frac{1}{2}+\frac{2}{2!}-\frac{2}{3!}+\frac{3}{3!}-\frac{3}{4!}\ldots\ldots\ldots=1+\frac{1}{2!}+\frac{1}{3!}+\frac{1}{4!}+\ldots\ldots\ldots=e-1.$$

Also solved by G. W. Greenwood, J. Scheffer, and the Proposer.

AVERAGE AND PROBABILITY.

162. Proposed by **F. P. MATZ**, Ph. D., Sc. D., Reading, Pa.

Two points are taken at random in the surface of a circle and a chord is drawn through them. Find the average area of the segment containing the center of the circle.

Solution by the **PROPOSER**.

Let $2\theta=$the sectoral angle, then the area of the segment in question is $U=\frac{1}{2}(2\pi-2\theta+\frac{1}{2}\sin 2\theta)r^2$.

$$\therefore A=\frac{r^2}{\pi}\int_0^{\frac{1}{2}\pi}Ud\theta=\tfrac{1}{2}\left(\frac{3\,\pi}{2}+\frac{1}{\pi}\right)r^2.$$

CALCULUS.

199. Proposed by **F. P. MATZ**. Sc. D., Ph. D., Reading, Pa.

If the perimeter of an ellipse varies uniformly at the rate of $\frac{1}{4}$ inch per unit of time, at what rate is the eccentricity varying the instant the perimeter becomes 60 inches and the major axis 25 inches?

No correct solution for this problem has been received.

200. Proposed by **R. D. CARMICHAEL**, Hartselle, Alabama.

Find the equation of a curve so that the area bounded by the curve, the axis of x, and any ordinate y, is equal to $y-x$, x being the *corresponding* abscissa.